REMARKS/ARGUMENTS

Claims 1, 2, 5, and 9-12 are pending in this application. By this Amendment, Applicant AMENDS claims 1, 2, 10, and 11 and CANCELS claims 3, 4, 6-8, 13, and 14.

Applicant affirms election of Group I, including claims 1, 2, 5, and 9-12. Claims 6-8, 13, and 14 have been canceled since these claims are directed to non-elected inventions. Applicant reserves the right to file Divisional Applications to pursue non-elected claims 6-8, 13, and 14.

The Examiner noted that the substitute specification filed on June 28, 2006 was not entered because the Applicant did not make a statement that the substitute specification did not include new matter. Applicant's undersigned representative hereby declares and states that the substitute specification filed on June 28, 2006 does not add any new matter whatsoever to the instant patent application. Accordingly, entry and consideration of the substitute specification filed on June 28, 2006 are respectfully requested.

Claims 1-5 and 9-12 were rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Applicant has canceled claims 3 and 4 and has amended claims 1, 2, 10, and 11 to correct the informalities noted by the Examiner. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 2, 5, and 9-12 under 35 U.S.C. § 112, second paragraph.

Claims 1-5 and 9-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Kanekiyo et al. (U.S. 6,706,124).

As indicated above, Applicant has canceled claims 3 and 4. Applicant respectfully traverses the rejection of claims 1, 2, 5, and 9-12.

Claim 1 has been amended to recite:

> An iron-based rare-earth nanocomposite magnet having a composition represented by the formula: $\mathbf{T_{100-x-y-z-n}Q_xR_yTi_zM_n}$, **where** T is either Fe alone or Fe in combination with at least one element selected from the group consisting of Co and Ni; **Q is at least one element selected from the group consisting of B and C;** R is at least one rare-earth element including substantially no La or Ce; and M is at least one metal element selected from the group consisting of Al, Si, V, Cr, Mn, Cu, Zn, Ga, Zr, Nb, Mo, Ag, Hf, Ta, W, Pt, Au and Pb, the mole fractions x, y, z and n satisfying the inequalities of
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> **$5\ at\% \leq x \leq 10\ at\%$,**

7 at% ≤ y ≤ 10 at%,
0.1 at% ≤ z ≤ 5 at% and
0 at% ≤ n ≤ 10 at%, respectively,

wherein the magnet includes $R_2T_{14}Q$ compound phases and α-Fe phases that form a magnetically coupled nanocomposite magnet structure, and

wherein the $R_2T_{14}Q$ compound phases have an average crystal grain size of 20 nm or more and **the α-Fe phases are present at grain boundary triple points in a grain boundary region between the $R_2T_{14}Q$ compound phases, the grain boundary region having a thickness of 20 nm or less,**

wherein a ratio of the average crystal grain size of the $R_2T_{14}Q$ compound phases relative to that of the α-Fe phases is 2.0 or more, and

wherein the magnet has magnetic properties including a coercivity of at least 400 kA/m and a remanence of at least 0.9 T. (emphasis added)

Applicant's claim 10 recites method steps that are similar to the features recited in Applicant's claim 1, including the above-emphasized features.

With the unique combination and arrangement of features and method steps recited in Applicant's claims 1 and 10, including the features of "$T_{100-x-y-z-n}Q_xR_yTi_zM_n$, where ... Q is at least one element selected from the group consisting of B and C," "5 at% ≤ x ≤ 10 at%," "the α-Fe phases are present at grain boundary triple points in a grain boundary region between the $R_2T_{14}Q$ compound phases, the grain boundary region including a thickness of 20 nm or less," "wherein a ratio of the average crystal grain size of the $R_2T_{14}Q$ compound phases relative to that of the α-Fe phases is 2.0 or more," and "wherein the magnet has magnetic properties including a coercivity of at least 400 kA/m and a remanence of at least 0.9 T," Applicant has been able to provide an iron-based rare-earth nanocomposite magnet exhibiting magnetic properties including a coercivity of at least 400 kA/m and a remanence of at least 0.9 T (see, for example, paragraph [0008] of Applicant's substitute specification).

The Examiner alleged that Kanekiyo et al. teaches all of the features recited in Applicant's claims 1 and 10, except that "Kanekiyo [et al.] does not teach the exact same alloy proportions as recited in the instant claims and the Kanekiyo [et al.] is silent with respect to the thickness of the $R_2Fe_{14}B$ as recited in claim 1, line 21 and claim 10, line 28." However, the Examiner alleged that "one of ordinary skill in the art at the time the invention was made would

have considered the invention to have been obvious because the iron based rare earth alloy proportions taught by Kanekiyo [et al.] overlap the instantly claimed proportions and therefore are considered to establish a prima facie case of obviousness" and "one of ordinary skill in the art at the time the invention was made would have expected the $R_2Fe_{14}B$ thickness of Kanekiyo [et al.'s] iron based rare earth alloy to be the same as recited in applicants' claims because Kanekiyo [et al.'s] iron based rare earth alloy has a composition that overlaps the iron based rare earth alloy recited in the instant claims and is made by a process which is similar to, if not the same as, applicants' process of making the instantly claimed alloy(see the table above)."

Applicant's claims 1 and 10 recite the features of "$T_{100-x-y-z-n}Q_xR_yTi_zM_n$, where ... Q is at least one element selected from the group consisting of B and C," "5 at% ≤ x ≤ 10 at%," and "wherein the magnet has magnetic properties including a coercivity of at least 400 kA/m and a remanence of at least 0.9 T," and Applicant has amended claims 1 and 10 to further recite the features of "the α-Fe phases are present at grain boundary triple points in a grain boundary region between the $R_2T_{14}Q$ compound phases, the grain boundary region including a thickness of 20 nm or less," and "wherein a ratio of the average crystal grain size of the $R_2T_{14}Q$ compound phases relative to that of the α-Fe phases is 2.0 or more." Support for these features is found, for example, in Applicant's originally filed claims 3 and 4.

Kanekiyo et al. does not teach or suggest these features and, contrary to the Examiner's allegations, it would not have been obvious to modify the manufacturing steps of Kanekiyo et al. to provide the presently recited alloy proportions.

Kanekiyo et al. is directed to an iron-based boride/$R_2Fe_{14}B$ based nanocomposite magnet including an additive Ti. The nanocomposite magnets of Kanekiyo et al. are discussed in paragraph [0041] of Applicant's substitute specification and shown in Fig. 1(d) of Applicant's figures. The soft magnetic phase of the nanocomposite magnets of Kanekiyo et al. includes borides, such as Fe_3B, $Fe_{3.5}B$, and $Fe_{23}B_6$, and do not include or require α-Fe phases, as discussed for example, in claims 3-5 of Kanekiyo et al. The nanocomposite magnets of Kanekiyo et al. do not include the same components as presently recited in Applicant's claims 1 and 10.

The instant invention is directed to an iron-based α-Fe/$R_2Fe_{14}B$ based nanocomposite magnet including an additive Ti. Applicant's presently recited nanocomposite magnet has a composition represented by the formula: $T_{100-x-y-z-n}Q_xR_yTi_zM_n$, where the mole fraction x satisfies 5 at% ≤ x ≤ 10 at%. However, the mole fraction x of the magnets disclosed in Kanekiyo et al. is 10 at% < x < 20 at%. Thus, Kanekiyo et al. does not teach or suggest the features of "$T_{100-x-y-z-n}Q_xR_yTi_zM_n$, where ... Q is at least one element selected from the group consisting of B and C" and "5 at% ≤ x ≤ 10 at%" as recited in Applicant's claims 1 and 10.

Further, the presently claimed invention requires α-Fe phases that are in a grain boundary region between the $R_2T_{14}Q$ compound phases. More specifically, claims 1 and 10 recite that α-Fe phases are present at grain boundary triple points in a grain boundary region between the $R_2T_{14}Q$ compound phases, that the grain boundary region has a thickness of 20 nm or less, and that a ratio of the average crystal grain size of the $R_2T_{14}Q$ compound phases relative to that of the α-Fe phases is 2.0 or more. Kanekiyo et al. is completely silent with respect to these features.

The Examiner alleged that these features would be inherently produced in the magnet of Kanekiyo et al. if the method of Kanekiyo et al. was adjusted to fall within the presently recited ranges. However, whether or not the mole fraction x of Q satisfies 5 at% ≤ x ≤ 10 at% or not is critical or relevant to the enhanced formation of α-Fe phases. The existence of a mole fraction x of Q that satisfies 5 at% ≤ x ≤ 10 at% would not be formed merely by altering the ranges in the method of making of Kanekiyo et al.

Paragraph [0071] of Applicant's substitute specification recites:

> [I]f the mole fraction x of Q exceeded 10 at%, then the percentage of the α-Fe phase, which has a higher saturation magnetization than any other constituent phase, would decrease and soft magnetic phases such as Fe_3B, $Fe_{3.5}B$ and $Fe_{23}B_6$ would nucleate and a remanence B_r of 0.9 T or more could not be achieved. In view of these considerations, the mole fraction x of Q is preferably set to fall within the range of 5 at% to 10 at%, more preferably 5.5 at% to 9.5 at%, and even more preferably 5.5 at% to 9.0 at%. The upper limit of a further preferred range of the mole fraction x is 8 at%.

In light of this discussion, it is clear that the product made by the method of Kanekiyo et al. has significantly different components from that of the presently claimed invention, and thus, the structure of the magnet of Kanekiyo et al. is significantly different from that of the claimed invention. That is, because the method of Kanekiyo et al. would exceed the claimed mole fraction of x, the soft magnetic phases would nucleate and the formation of a remanence of 0.9 T or more could not be achieved.

Thus, Kanekiyo et al. clearly fails to teach or suggest the features of the α-Fe phases are present at grain boundary triple points in a grain boundary region between the $R_2T_{14}Q$ compound phases, the grain boundary region having a thickness of 20 nm or less," "wherein a ratio of the average crystal grain size of the $R_2T_{14}Q$ compound phases relative to that of the α-Fe phases is 2.0 or more," and "wherein the magnet has magnetic properties including a coercivity of at least 400 kA/m and a remanence of at least 0.9 T" as recited in Applicant's claims 1 and 10.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1 and 10 under 35 U.S.C. § 103(a) as being unpatentable over Kanekiyo et al.

In view of the foregoing amendments and remarks, Applicant respectfully submits that claims 1 and 10 are allowable. Claims 2, 5, 9, 11, and 12 depend upon claims 1 and 10, and are therefore allowable for at least the reasons that claims 1 and 10 are allowable.

In view of the foregoing amendments and remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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